How Higher–Performance PCs Can Enhance e-Learning

Essential
Business
Technologies
Series

Performance with Purpose

Got a minute?

When it comes to information technology, one thing's for sure — the pace of innovation shows no signs of slowing.

That's good, because if your company applies the latest technologies faster and more effectively than your competition, you can gain a significant edge.

But first, you have to learn what each new application or technology is all about.

It's not easy. Who has time to sort through the wealth of material and find the nuggets of relevant information? Who wants to wade through the hype to find the substance?

This series is designed to help. Each booklet provides a quick, no-spin overview of an essential new business technology — what it is, how it can benefit your company, and how it's likely to impact your enterprise infrastructure.

When you're done reading, you should have a better understanding of a key enabler of next-generation computing — and maybe even saved a few minutes along the way.

Why is e-Learning an essential business technology?

The short answer: It helps you train your workforce more quickly, efficiently, and effectively. Compared to traditional instructor-led courses, e-Learning can reduce training costs by 30 to 60% and cut the time needed for instruction by 20 to 40%. It also increases the effectiveness of instruction by 30%.[1]

Those are powerful benefits — and they're the tip of the iceberg. e-Learning is much broader than training. Training implies one-way knowledge transfer: the organization imparts information to its employees. In a world of increasingly complex products and procedures, speed-of-light changes, and distributed workforces, that's not enough. The companies that win in this climate are the ones that create a learning culture in which every employee is an active, questing, non-stop learner.

Winning companies understand that in an information-driven economy, knowledge truly is power and learning isn't just what happens when you round up the latest batch of new hires or show workers how to use the latest software. At these organizations, learning — acquiring new knowledge, skills, and understanding and applying them to achieve desired results — happens every hour of the work day, at every level of the organization. Learning *is* the job, and e-Learning, which offers a wide range of interactive, distributed, user-empowering capabilities, is a new strategic imperative.

e-Learning helps you train your workforce efficiently and enable powerful, self-directed learning. Embed it in an active learning culture and you've got rewards every business covets: increased product quality, higher productivity, lower operating costs, and better customer service, plus an energized, educated, and engaged workforce.

Around the world, companies are making major investments in e-Learning. Already a $2.2 billion market in 2000, worldwide e-Learning investments will swell to $18.5 billion by 2005, according to International Data Corporation (IDC).[2] IDC says the U.S. is experiencing a dramatic 150% growth rate, to $11.4 billion by 2004.[3] Asia Pacific's e-Learning expenditures are rising at 25% annually,[4] and Data Monitor reports that Europe is growing to $6.2 billion, a 17% growth rate.[5]

[1] Study results reported by the Advanced Distributed Learning (ADL) initiative, www.adlnet.org/

[2] IDC research, reported in *InfoWorld,* E-Learning Leaps into the Limelight, Dec. 10, 2001.

[3] IDC research, reported in www.centra.com/corporate/analyst.asp

[4] IDC research, reported in Xinhuanet, Dec. 6, 2001.

[5] Data Monitor, Q1 2001.

"The speed of learning is the speed of business today. e-Learning can allow companies to move faster than the competition!"

Ed Sketch
Manager of
North American CBG
Business Solutions
Ford Learning Network
Ford Motor Company[6]

What's different about today's e-Learning solutions?

e-Learning tools have progressed far beyond the simple audio and video streaming that were state of the art just a year or two ago. Today's e-Learning combines rich media with new content development and delivery technologies to offer added value for organizations and employees alike.

- e-Learning content incorporates technologies such as Flash* and Shockwave* animations, streaming video, interactive simulations, and audio- and video-enabled PowerPoint* presentations, offering compelling, immersive experiences that make even highly complex topics easier to learn, understand, and remember.
- Peer-to-peer caching and content distribution systems help companies take maximum advantage of existing infrastructure and minimize the impact on expensive networks. P2P communication technologies such as instant messaging, online meetings, and small-group chat sessions augment media-rich content modules and classroom sessions.
- The Extensible Markup Language (XML) and sophisticated content management systems provide an open, standards-based approach to creating, organizing, and tracking "learning objects" and combining them as needed.

e-Learning Advantages

Timely	▪ Just-in-time delivery and user-initiated access ▪ No need to sign up weeks or months ahead
Personalized	▪ Users can access content modules when, where, and how they need them ▪ Self-pacing lets users go at their own speed
Customizable	▪ Content can be repackaged and repurposed in a variety of ways to meet specific needs
Efficient & economical	▪ Avoids the expense and hassles of travel and classroom logistics ▪ Content can be developed once and delivered to thousands of users ▪ Web allows economical distribution and simplified version control
Accountable	▪ Convenient, built-in monitoring and testing to help assess learning and track progress

[6] More e-Learning Champions, *e-Learning magazine,* March 18, 2002: www.elearningmag.com/elearning/article/articleDetail.jsp?id=12743

Where can e-Learning make a difference?

Whether your current training and knowledge transfer methods consist of formal classroom experiences or hollering questions over the cubicle wall, e-Learning can enrich and complement them. Here are a few typical e-Learning scenarios.

Business Challenge	e-Learning Solution	Impact
Factory floor workers must perform numerous procedures on an exception basis.	Just-in-time refreshers that use rich graphics, animations, and high-quality audio to demonstrate each procedure. Workers access the information through an easy-to-use portal just when they need it.	Workers save time and increase productivity and job satisfaction. The company cuts down on costly errors and avoids the expense and disruption of pulling workers off the factory floor for lengthy training courses.
Hundreds of support engineers and distributors around the world need to understand a complex new product, but the company has only a few prototypes.	Product demonstrations with high-resolution simulations and 3-D graphics models that can be viewed from all angles, exploded, manipulated, and assembled.	Support engineers and distributors get virtual "hands-on" experience and have the chance to "practice" the work they'll need to perform. The product launch goes smoothly and the company saves money on launch and support costs.
A whole generation of experts is about to retire.	Video that captures their knowledge and packages it into indexed, easily searchable chunks. Interactive, peer-to-peer chat sessions provide opportunities to ask follow-up questions, validate assumptions, etc.	The company cost-effectively transfers expertise to a new generation. Workers get quick answers to questions and gain insights into company history, culture, and intellectual property. Users can access information as they need it, so they're more likely to understand and remember it.
A regulated industry must demonstrate that employees have had extensive safety training.	Modular courseware that uses video and rich graphics to cover the required material. A content management system administers tests and tracks each worker's progress.	The company delivers the requisite training without the expense of travel and meeting room logistics, and can show regulators that its workforce meets the standards. Since e-Learning modules are self-guided, interactive, and visually compelling, users come away with a better grasp of the material, reducing accidents.

How does e-Learning impact my enterprise infrastructure?

e-Learning leverages your existing infrastructure. Like other essential business technologies, it works best in an environment of robust networks, flexible servers, and powerful clients. Because it makes extensive use of rich media, e-Learning also adds to the bandwidth requirements of your networks and can heavily tax your client systems.

Peer-to-peer content distribution systems minimize the bandwidth impact by moving network traffic off of expensive wide-area networks to more cost-effective local area networks. The P2P model also takes advantage of inexpensive PC storage, and these two factors together can significantly reduce the cost of e-Learning. With P2P computing and local caching, businesses can distribute video clips and rich graphics throughout the enterprise with little or no need for additional bandwidth. In a P2P environment, a 20-40 MB file typically downloads in less than a minute, in contrast to the 30 minutes that might be expected across a wide area network.

On the client side, systems must be powerful enough to avoid performance degradations that can dampen user productivity and even cause users to avoid e-Learning altogether. Client systems must have the horsepower, memory, storage capacity, and I/O throughput to decompress streaming video and audio, run detailed simulations and animations, manipulate complex 3-D models, and encrypt, decrypt, and store large files. The client load is also heightened by automated tasks such as virus scans that typically run in the background, outside the user's direct control. Finally, client systems must provide headroom to accommodate future applications, which are likely to continue a cycle of rising demands.

"There are tremendous efficiencies you can realize by delivering e-Learning online right at people's desks when they need it instead of sending them to a training [seminar]."

Charles Luce
Senior Analyst
Delphi Group[7]

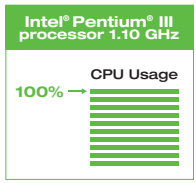
[7] *InfoWorld*, E-Learning Leaps into the Limelight, Dec. 10, 2001.

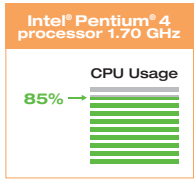
How can PCs based on the Intel® Pentium® 4 processor make a difference?

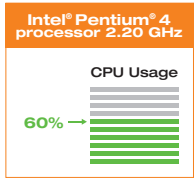
Intel® Pentium® 4 processor-based PCs offer performance with purpose for e-Learning, whether they're used at a knowledge worker's desktop, a factory floor kiosk, or a content developer's mobile PC. The Pentium 4 processor and its Intel® NetBurst™ microarchitecture were designed to deliver outstanding performance on precisely the types of next-generation technologies that give today's new e-Learning solutions their power. And each uptick of the processor clock speed delivers further improvements.

Industry-standard benchmarks confirm that the Pentium 4 processor is superbly suited to handle the rich, interactive applications that are a key to effective e-Learning. The WebMark* 2001 benchmark with Flash* visualization technology showed a Pentium 4 processor 2.53 GHz with the new 533 MHz system bus running 317% faster than an Intel® Pentium® III processor 500 MHz, indicating exceptional performance for users viewing and interacting with e-Learning modules.[8] FlasKMPEG* with DivX* 4.11 encoding shows a Pentium 4 processor 2.40 GHz processor was 355% faster than a Pentium III processor 500 GHz — an indicator of the outstanding performance content developers will see as a result of the processor's digital video encoding performance.[9]

e-Learning excels on high-performance clients







When running a Cisco Systems e-Learning module that uses Shockwave*, an Intel® Pentium® III processor 1.10 GHz was maxed out, and an Intel® Pentium® 4 processor 1.70 GHz was close. The Pentium 4 processor 2.20 GHz, at 60% CPU utilization, had ample horsepower to run the processing-intensive module and background tasks, plus headroom for future applications that are likely to be even more demanding.[10]*

[8] [9] [10] For configuration details, see page 10.

"Focus on the business advantage — benefits gained — not just costs saved. It's pretty easy to show distinct business advantages such as flexibility and scalability combined with cost savings. Seize that opportunity."

Tony Cox
Manager
Intel University
Intel Corporation[11]

What best practices have been developed for e-Learning?

- **Start from business problems.** Decide what business problems you're trying to solve, then develop solutions.
- **Build consensus.** Get input and buy-in from key stakeholders. Make sure senior management understands and communicates the value of e-Learning — and uses it.
- **Make it easy to create, share, and access content.** Ensure interoperability by designing an open, standards-based e-Learning infrastructure that can span the enterprise. Aim to provide the flexibility business units need while offering consistent tools and formats across the enterprise. Use learning content management systems to organize content, and integrate the content into your employee portal for easy access.
- **Match the technology to the task.** Don't expect one type of content to cover all needs. Emphasize interactivity and communication, since active participation enhances learning. Create visually compelling content that engages and challenges the learner.
- **Plan for security from the outset.** Information security solutions are more robust when they're designed in from the start rather than bolted on after a breach has occurred. Confidential material should be encrypted for transmission and storage.
- **Analyze infrastructure impacts.** Don't let unexpected performance hits diminish the user's willingness to use your e-Learning solutions.
- **Measure your results.** Monitor and evaluate how effective your solutions are, who's using them, and what they're learning. Use that information to refine your next-generation deployments — and secure funding for them.

[11] Crawford, Sally & Dr. Bonnie Becker. Winning Strategies: Proven Tips to Do a Lot with a Little, *e-Learning Magazine,* Nov. 1, 2001: www.elearningmag.com/elearning/article/articleDetail.jsp?id=5037

What's next?

Here's a safe assumption: The factors that are spurring e-Learning's rapid rise will continue apace, and the use of e-Learning solutions will grow rapidly and spread to new areas of the business.

Beyond that, look for e-Learning to be increasingly integrated with other productivity-oriented information technologies. e-Learning will add value to everything from collaboration and knowledge management solutions to employee portals. As client performance continues to rise, e-Learning will no doubt expand its reliance on rich visual media, with greater use of 3-D graphics models, simulations, and streaming video. The expansion of peer-to-peer computing will increasingly bring instant messaging, online conferencing, and other distributed technologies into the e-Learning solution space and foster the development of ad hoc learning communities.

Above all, you can count on a wider recognition of the importance of e-Learning as a business differentiator. As Josh Bersin writes in *e-Learning Magazine,* e-Learning is:

> ...a new strategic business tool to make your company perform better. It enables you to do things you could never do before.
>
> For example, at Circuit City e-Learning has enabled a dramatic reduction in turnover and increase in sales force effectiveness that was impossible any other way. At Charles Schwab, e-Learning has become a critical marketing tool for acquiring new customers and educating customers on how to make more money (and purchase more products).
>
> Those are not "training" solutions, but rather "business performance" solutions.[12]

e-Learning impacts the bottom line. Case in point: Data storage vendor EMC* is using engaging, "virtual laboratory" simulations to train 4,000 technical support personnel on how a new software package integrates with customers' existing hardware. EMC expects the solution to save them more than $3 million this year![13]

[12] Bersin, Josh. Measuring e-Learning: The Third Wave, *e-Learning Magazine,* Feb. 1, 2002: www.elearningmag.com/elearning/article/articleDetail.jsp?id=9554

[13] Hickey, Eamon. New Tricks, *Smart Business Magazine,* May, 2002: www.smartbusinessmag.com/ article/0,3658,s=103&a=25455,00.asp

Terms and acronyms

ADL – Advanced Distributed Learning Initiative. Created by the U.S. Department of Defense and now including a broad partnership program with industry and academia, ADL promotes the development of e-Learning solutions that are interoperable, durable, reusable, adaptable, and affordable.

CDN – Content Delivery Network. A technique pioneered by Internet service providers and high-traffic public Web sites that pushes large files and other content to the edge of the network, for quicker delivery to end users.

IMS – IMS Global Learning Consortium. A worldwide organization that develops and promotes open specifications for online distributed learning activities such as locating and using educational content, tracking learner progress, reporting learner performance, and exchanging student records between administrative systems. IMS originally stood for Instructional Management Systems; today, the organization has dropped the name but kept the acronym.

LCMS – Learning Content Management System. XML-based software that reduces the time, complexity, and cost of developing e-Learning materials by making it possible to create materials in small, recombinable "objects." LCMS packages tag, store, track, and deliver content and facilitate a flexible, "develop once, deploy in a variety of ways" model for e-Learning.

LRN – Learning Resource Interchange. Microsoft's toolkit for developing interchangeable online learning content. LRN is based on the IMS Content Packaging 1.1 and Metadata 1.2 specifications.

P2P – Peer to Peer. A networking and programming model in which applications take advantage of the array of resources on the network by directly exchanging resources from PC to PC, without a central file server.

SCORM* – Shareable Content Object Reference Model. An industry-standard compatibility initiative, developed by ADL, that uses the Extensible Markup Language (XML) to represent content as objects that can then be searched, combined, etc.

XML – Extensible Markup Language. A cornerstone technology for e-Learning, as it is for information sharing in numerous other areas. XML data can be tagged and repurposed in a variety of ways, simplifying the development and expanding the value of e-Learning content.

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[8] **Source: Intel. Configuration: Intel® Pentium® III processor at 500MHz** - Intel® Desktop Board SE440BX-2, 128 MB PC100 CL2 SDRAM, VIPER 550 TNT Graphics; **Intel® Pentium® 4 processor at 2.20 GHz**- Intel® Desktop Board D850MD, 256 MB PC800 RDRAM - 45; **Pentium® 4 processor at 2.40 GHz and 2.53 GHz** - Intel® Desktop Board D850MV2, 256 MB PC800 RDRAM - 45; **All Platforms except Pentium III processor at 500 MHz** - Leadtek* WinFast GeForce* 3/ nVidia* GeForce 3 4x AGP Graphics, nVidia Detonator* v21.81 Graphics Driver; Intel® Application Accelerator Driver v1.10, Intel® chipset INF file v3.20.1008, Intel C & Fortran compilers 5.01 for SPEC; IBM* 30GB ATA-100 DTLA-307030 Hard Drive, DirectX* 8.1, Windows* XP, 100 Mbps Intel Pro/100+ Management PCI LAN Card. *Performance tests and ratings are measured using specific computer systems and/or components and reflect the approximate performance of Intel products as measured by those tests. Any difference in system hardware or software design or configuration may affect actual performance.*

[9] **Source: Intel. Configuration: Intel® Pentium® III processor at 500MHz** - Intel® Desktop Board SE440BX-2, 128 MB PC100 CL2 SDRAM, VIPER 550 TNT Graphics; **Intel® Pentium® 4 processor at 2.20 GHz**- Intel® Desktop Board D850MD, 256 MB PC800 RDRAM - 45; **Pentium 4 processor at 2.40 GHz and 2.53 GHz** - Intel Desktop Board D850MV2, 256 MB PC800 RDRAM - 45; **All Platforms except Pentium III processor at 500 MHz** - Leadtek* WinFast GeForce* 3/ nVidia* GeForce 3 4x AGP Graphics, nVidia Detonator* v21.81 Graphics Driver; Intel® Application Accelerator Driver v1.10, Intel chipset INF file v3.20.1008, Intel C & Fortran compilers 5.01 for SPEC; IBM* 30GB ATA-100 DTLA-307030 Hard Drive, DirectX* 8.1, Windows* XP, 100 Mbps Intel Pro/100+ Management PCI LAN Card. *Performance tests and ratings are measured using specific computer systems and/or components and reflect the approximate performance of Intel products as measured by those tests. Any difference in system hardware or software design or configuration may affect actual performance.*

[10] **Source: Intel. Configuration: Intel® Pentium® III processor at 1.10 GHz** - Intel Desktop Board D815EA; 128MB PC133 CL2 SDRAM; **Intel® Pentium® 4 processor at 1.70 GHz, 2.20 GHz** - Intel Desktop Board D850MD, 256 MB PC800 RDRAM - 45. **All platforms except Pentium III processor at 1.10 GHz** - Leadtek* WinFast GeForce* 3/ nVidia* GeForce 3 4x AGP Graphics, nVidia Detonator* v21.81 Graphics Driver; Intel Application Accelerator Driver v1.10, Intel chipset INF file v3.20.1008, Intel® C & Fortran compilers 5.01 for SPEC; IBM* 30GB ATA-100 DTLA-307030 Hard Drive, DirectX* 8.1, Windows* XP, 100 Mbps Intel® Pro/100+ Management PCI LAN Card. *Performance tests and ratings are measured using specific computer systems and/or components and reflect the approximate performance of Intel products as measured by those tests. Any difference in system hardware or software design or configuration may affect actual performance.*

Intel and e-Learning

Intel is well known as the company whose state-of-the-art microprocessors are “inside” the world’s leading personal and laptop computers. In addition, Intel provides an array of building block technologies for the Internet economy, from servers to network components to hand-held wireless devices.

Intel plays a leading role in accelerating the development of new technologies and solutions. Through R&D efforts, Intel Capital investments in creative, new companies, and collaborations with other industry leaders, Intel spurs innovation on numerous fronts.

The company is strongly committed to e-Learning as a competitive differentiator. Intel deploys a wide range of e-Learning tools throughout its corporate environment, including over 1,000 self-directed courses and role-based interactive training modules offered to employees, as well as select courses available to partner members of Intel’s eBusiness Network. Intel is proud to have received a 2001 Excellence in e-Learning award for innovative technology from Online Learning and brandon-hall.com for its internally deployed “Share and Learn” software.

Performance with Purpose

Learn more about e-Learning solutions — and how Intel® Pentium® 4 processor-based PCs can enhance them.

Intel® Pentium® 4 Processors for Business

http://www.intel.com/ebusiness/products/desktop/p4p/index.htm

Visual Business Computing:

http://www.intel.com/ebusiness/products/desktop/p4p/wp013305_sum.htm

Advanced Distributed Learning Initiative and SCORM

www.adlnet.org

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